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**ENERGY REPORT**

FINAL 17 March 85

**ENERGY ENGINEERING  
ANALYSIS PROGRAM**

**ENERGY SURVEY OF ARMY  
INDUSTRIAL FACILITIES**

**WESTERN AREA DEMILITARIZATION FACILITY  
HAWTHORNE ARMY AMMUNITION PLANT  
HAWTHORNE, NEVADA**

**VOLUME I**

**PREPARED FOR**

**DEPARTMENT OF THE ARMY  
SACRAMENTO DISTRICT, CORPS OF ENGINEERS  
SACRAMENTO, CALIFORNIA**

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## 1.0 Executive Summary

### 1.1 Introduction

This report summarizes all work for the Energy Survey of Army Industrial Facilities, Energy Engineering Analysis Program (EEAP) at the Western Area Demilitarization Facility (WADF) of the Hawthorne Army Ammunition Plant (HWAAP), Hawthorne, Nevada, authorized under Contract No. DACA05-92-C-0155 with the U.S. Army Corps of Engineers, Sacramento District, California.

The purpose of this energy survey is to develop a set of projects and actions that will reduce energy consumption and operating costs of selected facilities at the WADF.

A preliminary inspection of facilities at WADF by Keller & Gannon that identified potential retrofit opportunities was submitted as the EEAP Study and Criteria Review in December 1993. This document formed the basis of the Detailed Scope of Work for this study. Facilities included in the survey and study, together with operational status, are listed in Table 1-1. The complete scope of work appears in Appendix A.

### 1.2 Energy Conservation Analyses

Energy conservation opportunities (ECOs) evaluated are limited to those identified in the EEAP Study and Criteria Review of December 1993. Major areas of investigation included:

- Improvements and repairs to central plant steam generating systems and building heating, ventilating and air conditioning (HVAC) system equipment.
- Building envelope modifications including wall and roof insulation and infiltration controls.
- Building HVAC system control improvements and heat recovery retrofits from process sources and from building exhausts.
- Improvements and repairs to central plant compressed air systems and building compressed air utilizing equipment.
- Modifications to high pressure water pumps serving the steamout building.
- Lighting system fixture and control retrofits.

Energy conservation opportunities recommended for implementation are summarized on Table 1-2. These ECOs all have savings to investment ratios (SIR) above 1.25 and payback periods of 10 years or less. Projects evaluated but not achieving minimum economic criteria are listed on Table 1-3.



### 1.3 FEMP Project Developed

A Federal Energy Management Program (FEMP) qualifying project covering recommended ECOs in the surveyed facilities is developed. A complete, ready for signature, funding request package is prepared consisting of: DD Form 1391, Detailed Economic Justification and Project Development Brochure, PDB-I.

The FEMP program is selected for the funding request because the Energy Conservation Investment Program (ECIP), for which the project qualifies economically, does not support installation of direct digital control (DDC) systems. The FEMP program, coming from operating and maintenance funds, does not prohibit DDC systems from being selected, providing more freedom of design at the installation level. The funding request package consists of all recommended ECOs shown on Table 1-2, including:

- a. Replace all WADF building HVAC system steam condensate return systems including pump and piping repairs.
- b. Reduce central plant (Building 117-2) operating steam pressure, install a properly-sized deaerating feedwater preheater and repair steam distribution system leaks.
- c. Install oxygen trim combustion controls and flue gas economizer to preheat boiler make-up water on the central steam plant (Building 117-2) package boiler.
- d. Replace existing HVAC system pneumatic controls with DDC control systems in all WADF buildings. Retain pneumatic-operated damper and valve actuators.
- e. Install air curtains on roll-up doors of WADF Buildings 117-5 and 117-6 (tower structures) to reduce losses of conditioned air.
- f. Install run-around type heat recovery systems on WADF Buildings 117-5 and 117-6.
- g. Repair insulation on Building 117-5 and 117-6 melt kettles and separation tank steam heating jackets.
- h. Replace existing central plant Building 117-2 screw-type air compressors with a modern 2-stage rotary screw-type air compressor system, reusing and renovating existing refrigerated air dryers.
- i. Install variable speed drives and modify pump controls on high pressure water pumps located in Building 117-6A which serve the steamout Building 117-6.



j. Modify lighting fixtures as follows:

- (1) Delamp and modify 4 two-F40T12 lamp fluorescent lighting fixtures with standard magnetic ballasts to one-F32T8 lamp lighting fixtures with electronic ballasts in WADF Building 117-1.
- (2) Delamp and modify 57 four-F40T12 lamp fluorescent lighting fixtures with standard magnetic ballasts to two-F32T8 lamp lighting fixtures with electronic ballasts in WADF Buildings 117-1, 117-3, 117-4, 117-5, 117-6, 117-8 and 117-10.
- (3) Retrofit light emitting diode (LEDs) in 81 existing exit sign fixtures located in WADF Buildings 117-1, 117-3, 117-4, 117-5, 117-6, 117-8 and in 117-10.
- (4) Delamp and modify 118 four-F40T12 lamp fluorescent lighting fixtures with standard magnetic ballasts to two-F32T8 lamp lighting fixtures with electronic ballasts and specular reflectors in WADF Buildings 117-1, 117-3, 117-4, 117-6, 117-7, 117-8 and 117-10.
- (5) Replace 6 existing 100-watt incandescent lamps and bases with DTT-26 compact fluorescent lamps and ballasts in WADF Buildings 117-3, 117-4 and 117-5.
- (6) Replace 3 existing 150-watt incandescent lamps and bases with DTT-26 compact fluorescent lamps and ballasts in WADF Buildings 117-3, 117-4 and 117-5.
- (7) Retrofit 138 exterior 175-watt mercury vapor lighting fixtures with 50-watt high pressure sodium lamps and ballasts at WADF Buildings 117-1, 117-2, 117-3, 117-4, 117-5, 117-6, 117-6A, 117-7, 117-8, 117-10 and 117-11.
- (8) Retrofit 43 existing 400-watt metal halide lighting fixtures with 250-watt high pressure sodium lamps and ballasts at WADF Buildings 117-4, 117-5, 117-6 and 117-7.

The following FEMP project data is taken from the DD Form 1391 life cycle cost analysis summary sheet:

Construction Cost (including SIOH and design costs)	\$1,617,064
Annual energy savings	
Electricity	4,003 million BTU
Electric demand	160 kW
No. 2 Fuel Oil	34,460 million BTU
Annual dollar savings	\$359,091
Savings-to-investment ratio (SIR)	2.87
Simple payback period	4.50
Analysis date	March 1995



**Table 1-1**  
**Western Area Demilitarization Facility, HWAAP**  
**List of Facilities**

<b>Building No.</b>	<b>Building Name</b>	<b>Building Area (SF)</b>	<b>Current Operating Status</b>
117-1	Services and Support Building	9,600	Operational
117-2	Boiler Building	13,500	Operational
117-3	Decontamination and Small Items Building	21,650	Operational
117-4	Bulk Explosives Disposal Building	9,085	Non-Operational
117-5	Refining Building	5,060	Operational
117-6	Steamout Building and Addition	5,750 (N) 5,750 (S)	Undergoing Fit-up Operational
117-6A	Pump House	1,000	Operational
117-8	Mechanical Removal Building	8,250	Operational
117-9*	Large Cells Building	3,450	Non-Operational
117-10	Preparation Building	17,100	Non-Operational
117-11	Accumulator Building	2,470	Non-Operational
117-12*	Off-Loading Dock	4,680	Non-Operational
117-13*	Magazines Group A	1,875	Non-Operational
117-14*	Magazines Group B	1,250	Non-Operational
117-15	Flashing Chamber	7,385	Acceptance Testing for TVA Fuel Oil Modification
117-15A*	Antechamber	N/A	Decommissioned

\* Denotes buildings not included in the Energy Survey Scope of Work.



Table 1-2. Summary of Analysis Results for Recommended Energy Conservation Opportunities

Description of Energy Conservation Opportunity	Electric Demand kW/yr	Energy Savings Fuel Oil Million BTU/yr	Energy \$/Year	Energy LCC\$	O & M Savings		Total Savings Annual \$/Year	Life Cycle LCC\$	Retrofit Invest- ment \$	Economic Analysis		
					Savings \$/Year	LCC\$				SIR	Payback Years	
Central Steam Plant and Distribution System Energy Conservation Opportunities (Refer to Appendix E)												
Replace Building Condensate Return Systems	0	0.0	1,100	\$6,743	\$95,957	\$0	\$0	\$8,743	\$95,957	\$64,200	1.49	9.52
Reduce Steam Pressure, Install New Deserator, and Repair Steam Leaks	0	0.0	21,218	\$130,030	\$1,850,332	(\$2,714)	(\$32,402)	\$115,725	\$1,687,577	\$202,624	8.33	1.75
Install Oxygen Trim Combustion Controls & Flue Economizer	(8,009)	(0.91)	1,435	\$8,348	\$119,770	(\$2,501)	(\$29,856)	\$5,847	\$89,914	\$60,280	1.49	10.31
Subtotal: Central Steam Plant Energy Conservation Opportunities	(8,009)	(0.91)	23,763	\$145,121	\$2,066,059	(\$5,214)	(\$62,268)	\$128,316	\$1,873,447	\$327,104	6.73	2.66
Building Envelope, HVAC System Control and Heat Recovery Energy Conservation Opportunities (Refer to Appendix D)												
Bldgs 117-1,3,4,5,6,8,10&11 HVAC System: Install DDC Controls Retrofits	86,962	4,779	\$39,743	\$371,451	\$42,079	\$358,934	\$138,429	\$1,296,453	\$739,286	\$1,296,453	1.75	5.34
Bldgs 117-5 & 117-6: Install Air Curtains on Roll-Up Doors	(27,798)	(4.85)	1,218	\$5,744	\$112,676	(\$42)	(\$619)	\$5,702	\$112,057	\$37,777	2.97	6.62
Bldg 117-5 & 117-6: Install Exhaust Air Heat Recovery Run-Around Loop	3,763	(0.28)	3,997	\$24,631	\$456,924	(\$2,032)	(\$30,234)	\$22,599	\$426,690	\$113,461	3.76	5.02
Subtotal: Building HVAC System and Heat Recovery ECOs	72,927	66.6	9,994	\$70,118	\$941,061	\$40,006	\$328,081	\$166,730	\$1,836,200	\$890,624	2.06	6.34
Process Equipment Insulation Energy Conservation Opportunities (Refer to Appendix F)												
Repair Building 117-5 & 6 Melt Kettle and Separation Tank Insulation	0	0.00	713	\$4,368	\$62,164	\$0	\$0	\$3,665	\$53,687	\$5,907	9.09	1.61
Central Air Compressor System Energy Conservation Opportunities (Refer to Appendix I)												
Replace Existing with SSR 2-Stage Rotary Screw, Use Existing Air Dryers	293,959	59.93	0	\$18,987	\$286,329	(\$2,234)	(\$33,240)	\$19,577	\$309,560	\$166,785	1.86	8.52
High Pressure Water Pump, Steamout Building Annex 117-6A Energy Conservation Opportunities (Refer to Appendix J)												
Install Variable Speed Drive Retrofits on High Pressure Water Pumps	612,442	0.00	0	\$26,796	\$404,089	\$0	\$0	\$26,796	\$404,089	\$168,767	2.39	6.30



Table 1-2. Summary of Analysis Results for Recommended Energy Conservation Opportunities

Description of Energy Conservation Opportunity	Electric Demand kWh/Yr	Demand kW	Energy Savings		Energy \$/Year	Energy LCC\$	O & M Savings		Total Savings Annual \$/Year	Life Cycle LCC\$	Retrofit Invest- ment \$	Economic Analysis	
			Fuel Oil Million BTU/Yr				Savings \$/Year	Savings LCC\$				SIR	Payback Years
Lighting Fixture and Lighting Control Energy Conservation Opportunities (Refer to Appendix H)													
Lighting Fixture Delamping Retrofits													
LD-1: 2-Lamp F40T12 to 1-Lamp F32T8 with Electronic Ballast	879	0.22	0		\$61	\$732	\$7	\$82	\$68	\$815	\$302	2.69	4.46
LD-2: 4-Lamp F40T12 to 2-Lamp F32T8 with Electronic Ballast	22,109	6.33	0		\$1,614	\$19,400	\$196	\$2,344	\$1,810	\$21,745	\$5,268	4.13	2.91
Lighting Fixture Retrofits													
LF-1: Retrofit LED Lamp Kit in Existing Exit Lights	12,879	1.47	0		\$714	\$8,584	(\$57)	(\$676)	\$658	\$7,908	\$6,037	1.31	9.18
LF4B: Delamp 4-Lamp F40T12s to 2xF32T8s, Reflector, Electronic Ballast	54,275	13.10	0		\$3,713	\$44,635	\$371	\$4,434	\$4,085	\$49,069	\$9,925	4.84	2.43
LF-5: Replace 100W Lamp & Base with DTT-26W Compact Fluorescent	1,368	0.39	0		\$100	\$1,197	\$63	\$756	\$163	\$1,953	\$309	6.33	1.90
LF-6: Replace 150W Lamp & Base with DTT-26W Compact Fluorescent	215	0.35	0		\$45	\$537	\$6	\$67	\$50	\$604	\$154	3.91	3.07
LF-7: Retrofit Exterior 175W MV Fixture with 50W HPS Lamp & Ballasts	71,129	16.28	0		\$4,778	\$57,413	(\$261)	(\$3,116)	\$4,515	\$54,297	\$24,991	2.17	5.53
LF-8: Retrofit Explosion Proof 400W MH with 250W HPS Lamps & Ballasts	38,818	7.68	0		\$2,483	\$29,850	\$175	\$2,084	\$2,658	\$31,834	\$10,980	2.91	4.13
Subtotal, Recommended Lighting Energy Conservation Opportunities	201,669	46.82	0		\$13,607	\$162,349	\$601	\$5,976	\$14,007	\$168,326	\$67,967	2.90	4.14
Total Recommended ECOs													
	1,172,889	160	34,460	278,898	3,922,040	33,058	238,559	359,091	4,644,308	1,617,064	2.87	4.50	

**Table 1-3. Summary of Analysis Results for Energy Conservation Opportunities Not Recommended**  
(Energy Conservation Opportunities with SIR's below 1.25)

Description of Energy Conservation Opportunity	Energy Savings			O & M Savings			Total Savings		Retrofit Investment \$	Economic Analysis	
	Electric kWh/Yr	Demand kW	Fuel Oil Million BTU/Yr	Energy \$/Year	Savings LCC\$	Energy LCC\$	Annual Savings \$/Year	Annual Life Cycle LCC\$		SIR	Payback Years
Process Heat Recovery and Insulation Energy Conservation Opportunities (Refer to Appendix F)											
Recover Heat from Rotary Furnace Flues for Building 117-3 Heating	(3,223)	0.00	747	\$4,438	\$82,870 (\$922)	\$3,514	\$69,145	\$68,872	1.00	19.60	
Although this ECO shows an SIR of just over 1, the project is not recommended for implementation due to the marginal results.											
This project is not evaluated because it is very similar to the process heat recovery project evaluated above. Better economics are not expected.											
Recover Heat from Building 117-4 Incinerator Flues for Space Heating											
Recover Heat from Building 117-15 Flashing Chamber Flue for Heating											
This project cannot be installed without performing major process changes. Backpressure from a coil mounted in the flue would unbalance the process, possibly causing noncompliance with EPA pollutant discharge limits. (The units were recently tested for compliance; the system is sensitive to changes in flue gas flow adjustments).											
Central Air Compressor System Energy Conservation Opportunities (Refer to Appendix I)											
Replace Air Compressors with Model LL5 Compressors & Desiccant Dryer	257,211	34.21	0	\$14,751	\$222,442 (\$3,156)	\$48,968	\$16,371	\$271,001	\$235,684	1.15	14.40
Replace Air Compressors with Model LL5 Compressors; use existing Dryers	257,129	48.00	0	\$16,156	\$243,632 (\$3,217)	\$47,869	\$15,763	\$252,234	\$240,202	1.05	15.24
Replace Existing with SSR 2-Stage Rotary Screw and Desiccant Air Dryer	265,330	41.67	0	\$15,868	\$239,297 (\$2,448)	\$36,422	\$18,197	\$288,403	\$182,761	1.63	10.04
Building Envelope, HVAC System Control and Heat Recovery Energy Conservation Opportunities (Refer to Appendix D)											
Exhaust Heat Recovery - Single Story Industrial Bldg (117-3 as a Model)	(504)	(0.09)	124	\$730	\$13,670 (\$677)	\$10,078	\$53	\$3,593	\$20,901	0.17	394.75
Wall Insulation - Single Story Industrial Building (117-3 as a Model)	155,142	0.00	875	\$528	\$9,985 \$0	\$0	\$528	\$9,985	\$25,081	0.40	2.33
Wall Insulation - Tower Type Industrial Building (117-5 as a Model)	0	0.00	0	\$0	\$0	\$0	\$0	\$0	\$0	0.00	0.00
High Pressure Water Pump, Steamout Building Annex 117-6A Energy Conservation Opportunities (Refer to Appendix J)											
Replace HP Pump Electric Motors with Internal Combustion Engines	1,352,872	433.61	(6,318)	\$64,791	\$841,919 (\$8,237)	\$122,564	\$50,075	\$622,947	\$513,722	1.21	10.26

**Table 1-3. Summary of Analysis Results for Energy Conservation Opportunities Not Recommended**  
(Energy Conservation Opportunities with SIR's below 1.25)

Description of Energy Conservation Opportunity	Energy Savings			O & M Savings			Total Savings		Retrofit Investment \$	Economic Analysis		
	Electric kWh/Yr	Demand kW	Fuel Oil Million BTU/Yr	Energy \$/Year	Energy LCC\$	Savings \$/Year	Savings LCC\$	Annual \$/Year		Life Cycle LCC\$	SIR	Payback Years
Lighting Fixture and Lighting Control Energy Conservation Opportunities (Refer to Appendix H)												
Lighting Fixture Retrofits												
LF-2: Retrofit Electronic Ballast & 1x F32T8 in 1-Lamp F40T12 Fixture	858	0.49	0	\$48	\$1,058	(\$1)	(\$13)	\$87	\$1,045	\$1,791	0.58	20.60
LF-3A: Retrofit Electronic Ballast & 2x F32T8 in 2-Lamp F40T12 Fixtures	18,592	4.68	0	\$1,291	\$15,521	(\$32)	(\$388)	\$1,259	\$15,133	\$15,144	1.00	12.03
LF-3B: Electronic Ballast & 2x F32T8 Lamps in Industrial 2-Lamp F40T12s	21,890	8.10	0	\$1,788	\$21,463	(\$28)	(\$346)	\$1,757	\$21,118	\$24,973	0.85	14.22
LF-4A: Electronic Ballast & 4x F32T8 Lamps in Existing 4-Lamp F40T12s	24,448	5.90	0	\$1,673	\$20,108	(\$36)	(\$435)	\$1,636	\$19,671	\$18,190	1.08	11.12
ECO LF-4 has two options; option LF-4B, with better economics, is recommended for implementation. See Table 4-1.												
Lighting Control Retrofits												
LC-1: Install Ceiling Mounted Passive Infrared (PIR) Motion Sensors	9,715	0.00	0	\$425	\$5,109	\$0	\$0	\$425	\$5,109	\$9,568	0.53	22.51
LC-2: Install Ceiling Mounted Ultrasonic Motion Sensors	2,969	0.00	0	\$130	\$1,561	\$0	\$0	\$130	\$1,561	\$6,776	0.23	52.16
LC-3: Replace Wall-Switches with Passive Infrared (PIR) Switches	4,888	0.00	0	\$214	\$2,571	\$0	\$0	\$214	\$2,571	\$2,269	1.13	10.61

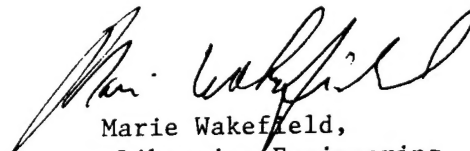


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